



## Systematics of Garnet Peridotite Melting: New Experimental Constraints

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Experiments carried out on a modified near-primary Tibetan shoshonite lava from 2.2 and 2.6 GPa and 1400 – 1460 °C provide new constraints on melting of subcontinental mantle in the garnet stability field. The compositions of four melts co-saturated with olivine, orthopyroxene, clinopyroxene and garnet were obtained. These four experiments increase the available experimental data set by ~25 %. Our new experimental data combined with the data of Kinzler (1997) JGR 102, p. 853, Longhi (2002) GGG v.3, no.3 and Walter (1998) J. Pet 39, p. 29 allow evaluation of the influence of pressure and mantle bulk composition on the compositions of melt produced from garnet lherzolite. We follow the method developed by Kinzler and Grove (1992) JGR 97, p. 6885 (K&G) that expresses the change in temperature and melt composition in terms of oxygen unit based mineral components. The change in temperature and melt components can be described by the following expressions:

$$(P-1) 1-Mg\# NaK\# P_2O_5 r^2$$

$$T(^{\circ}C) = 1308 + 8.6 P - 180 - 127 + 0.88 r^2$$

$$Oliv = 0.172 + 0.005 P + 0.239 - 0.086 - 0.056 r^2$$

$$Plag = 0.777 - 0.009 P - 0.585 + 0.570 - 0.102 r^2$$

$$Cpx = 0.136 + 0.001 P + 0.055 - 0.068 - 0.030 r^2$$

$$Qtz = -0.025 + 0.001 P + 0.156 - 0.447 + 0.024 r^2$$

where P is in kilobars,  $P_2O_5$  is in wt. %,  $r^2$  is the sum of residuals squared and the other parameters are from K&G. Melting temperature and composition in the conventional oxide wt. components can be obtained using the methods outlined in K&G.

These expressions allow the systematic characterization of the controls of mantle bulk composition on garnet peridotite melting. Melting is incongruent with opx formed along with melt. The effect of pressure on the garnet peridotite solidus is  $86\text{ }^{\circ}\text{C}/\text{GPa}$  over the pressure range of 2.2 to 6 GPa. The solidus of primitive mantle peridotite varies from 1420 to 1747  $^{\circ}\text{C}$  over this pressure range. Alkali content (NaK#) and Mg# have significant effects on the Qtz and Plag components (reflecting changes in silica undersaturation) as does Mg#. Increases in pressure increase the Oliv component.